

Marcos-Tostado Veliz, Bablesh Kumar Jha, Salah Kamel, Naran M. Pindoriya, Francisco Jurado, 2022, A three-stage Stochastic-IGDT model for photovoltaic-battery domestic systems considering outages and real-time pricing, *Journal of Cleaner Production*, Volume 370, 10 October 2022, 133558.

Abstract Energy consumption from residential sector is a growing concern nowadays. It has been widely demonstrated that domestic consumption worldwide could be notably reduced implementing home energy management tools. This kind of programs allows to schedule the different controllable home assets to optimize the electricity bill and increment the penetration of onsite renewable technologies, which contributes to a further reduction in residential consumption. On the other hand, grid outages are still frequent nowadays because natural disasters or weak infrastructures. Therefore, home energy management tools do not ignore these events. To tackle this issue, this paper develops a novel three-stage solution procedure for home energy management problems considering grid outages. To this end, a novel stochastic-IGDT formulation of the home energy management problem is proposed, by which the uncertain parameters are incorporated via scenarios and grid outages are modelled using IGDT. The presented formulation is Mixed-Integer Linear programming and allows to obtain a schedule result for the home appliances immune against outages without ignoring the economy of system. A benchmark prosumer environment with Real-Time pricing is considered as a case study. The results prove the effectiveness of the developed methodology. In particular, the effectiveness of the developed formulation in modelling grid outages as well as the scheduling performance at different conflictive objectives are highlighted. In addition, the effect of primarily considering robustness or economy is discussed together the importance of onsite photovoltaic generation in incrementing the reliability of the home system. Finally, the capability of the developed procedure to jointly consider cost and outages on a whole is foregrounded. In fact, the developed methodology is able to assume up to 6.5 outage hours without increasing the electricity bill, thus evidencing its capability to obtain a result immune against outages, whereas economic concerns are also considered on a whole.

Keywords Renewable energy, Home energy management, Grid outage, Real-time pricing, Battery energy storage